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The Climatic Station 'Beloye Ozero' [White Lake]

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Source: A part of a symposium, pages 13-29, entitled:

Beloye Ozero: Prirodnyye Lechebnyye Bogtstva
Kuybyshevskoy Oblasti [White Lake: Natural
Medical Resources of Kuybyshev Oblast].

Kuybyshev: 1938.

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"The Climatic Station 'Beloje Ozero' [White Lake]"

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[Note: The following report appeared in a book entitled 'White Lake: Natural Medical Resources of Kuybyshev Oblast', which was prepared by the Kuybyshev State Medical Institute under the general editorship of Docent V. A. Klimovitskiy and published in 1938 by the Kuybyshev Regional Press; pages 13 to 29.]

Beloje Ozero [White Lake] deserves particular attention, as a place of future sanatorium construction and as an excellent climatic station, in the vicinity of which small convalescence homes belonging to various organizations are located.

Kuybyshev State Medical Institute began in 1936 a general study of the microclimatic conditions of this region as well as physic-chemical and hydrological peculiarities of the lake. In the present work we give a comparative microclimatic description of this valuable work of nature.

For the climatic characteristics Beloje Ozero (Beloje Ozero Forest in Baranov Oblast) we consider three climatic zones: Kuybyshev, Kuznets Oblast, and Beloje Ozero. The two latter climatic zones are contiguous and therefore we have to review the climatic characteristics of Kuznets Oblast in somewhat more detail, because the microclimate of Beloje Ozero is closely connected with the climatic peculiarities of Kuznets Oblast. The author presents the characteristics of the Kuybyshev climatic zone as an example of great contrasts. Besides the analysis of the meteorological elements, actinometrical data are outlined in connection with effective

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temperatures in order to complete the picture of the climatic physiological character, absence of which would lessen the value of the climate for medical purposes.

The city of Kuybyshev is located at $53^{\circ} 11' 37''$ North Latitude and $50^{\circ} 15'$ East Longitude (Greenwich) on the left bank of the Volga River at the estuary of the Samara River on a wide cape bounded on the west side by the Samara River Valley. This cape at the same time serves as a watershed between the indicated rivers. The left bank is high, and the right is low with the marks: 29-33.5 [meters].

The general features of the climatic zone is characterized by sharp seasonal and diurnal temperature fluctuations, by abrupt changes from severe winter to hot summer, by the dryness of the air, and by strong insolation.

In connection with the general severity and instability of the climatic zone the annual amplitude of temperature fluctuations, according to monthly averages, reaches 34.7° , and 78.5° according to absolute maximum, with great departures from the monthly average into both directions. The mean temperature of January is -10.2° ; that of July is 21.8° .

The greatest rainfall for Kuybyshev is in June and July: 41.7 to 45.8 mm. The least precipitation is in February and March: 17.7 to 18 mm. The average amount of precipitation for the year is about 350 mm.

The snow cover is not too thick. Snow storms are most frequently in January; more rare in February and December.

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The greatest cloudiness is during the cold season of the year: November and December; the minimum is during the warm period of the year: June - August.

The prevailing winds are southwest. The east and southeast winds are distinguished by high temperature (dry winds). The average wind force is 3 to 5 m/sec.

The location of Kuybyshev on the high bank of the Volga River is favorable with respect to sanitation and hygiene, under conditions governing the proper sanitary state of the water basins and shores.

As for the dustiness of the town, investigations showed that the amount of dust deposited is 0.5 g/m^2 per a 24-hour day, while according to sanitary requirements it must not exceed 0.1 g/m^2 . The main reason for this is the calcareous soil, unpaved streets of the town's outskirts, lack of tree shelters from the dry winds, the dry sweeping of the streets, and a number of other circumstances. The dust of Kuybyshev, the pollution of the atmosphere due to the smoke of power stations and habitations, the dust and gases from industrial buildings and so on influence the atmosphere's radiational characteristics. As is known, dust suspended in the atmosphere increases considerably the scattering of solar radiation, and the short-wave radiations, which is especially active in the biological sense, is almost entirely absorbed. The long-wave radiation is least (the red part of the spectrum is heat rays), which falling on areas unsheltered by greenery is strongly reflected from the soil and thus increases the heat of the atmosphere.

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Rayleigh was first to prove that ^{if} the size of the scattering particles is less than the wavelength of the incident radiation, then scattering is ⁱⁿversely proportional to the fourth power of wave length. Knowing the law of dispersion one can compute how the diffusion in a pure atmosphere will occur. The results of such calculations are given in table 1.

The table permits one to make the very important conclusion that scattering increases considerably with decreasing wavelength. If the scattering of the red part of the spectrum (0.700 micron) is taken as unity, then the scattering of green rays (0.520 micron) is already 3.3 times more, and the scattering of extreme ultraviolet rays passing through the atmosphere (0.300 micron) is 30 times more. This conclusion possesses great significance for the calculation of dispersed radiation of a blue cloudless sky. Such (Rayleigh's) scattering of radiation occurs when the scattering particles are small, for instance molecules of gases.

Table 1

Color	Wave length (in microns)	Scattering
Red	0.700	1.0
Orange	0.620	1.6
Yellow	0.570	2.2
Green	0.520	4.2
Blue	0.470	4.9
Violet	0.440	6.4
	0.410	8.5
	0.375	12.0
	0.350	15.9
Ultraviolet	0.325	21.3
	0.310	26.0
	0.300	20.0

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The larger the size of the scattering particles, the more the scattering deviates from Rayleigh's Law. Thus if air contains a great amount of large particles, for instance, dust or smoke, the scattering will occur inversely proportional (approximately) to the second power of the wave-length. Therefore the maximum of scattering is shifted to longer wavelengths, and the sky becomes whitish and deficient in the short biologically-active ultraviolet (actinic) rays.

It is also known that the higher the air temperatures the greater is the content of water vapor, which possesses the ability to absorb radiation at a low temperatures and to re-emit it at higher temperatures. Therefore the humidity of the air under known conditions becomes still another thermal factor contributing to heat.

Tables 3 and 4 characterize the behavior of the basic meteorological elements in the summer months for the Kuybyshev observatory and also actinometrical data. Here we present effective temperatures as calculated by us according to the normal scale.

Table 2

Intensity of solar radiation, and water vapor.	
Intensity of radiation (in calories)	Amount of water vapor per m ³ of air (in grams)
1.35	2.8
1.25	4.8
1.15	6.4
1.05	8.7
0.95	11.6

Table 3

Months (1937)	Dry thermometer		Wet therm.		Relative humidity		Wind Velocity		Effective temperature	
	mean daily* for the month	at 1PM	mean daily* for the month	at 1PM	mean daily* for the month	at 1PM	Mean daily* for the month	at 1PM	mean daily* for the month	at 1 PM
June	17.9	21.5	12.6	14.9	62	48	4.0	5.3	11.5	14.5
July	21.7	25.5	16.6	17.7	60	45	2.5	4.0	16.0	18.5
August	20.2	23.8	15.2	16.5	60	47	4.6	5.0	13.0	16.5
September	16.0	20.2	11.8	13.5	62	47	4.0	4.2	8.0	12.5

(*Note: 24-hour period.)

From the given tables one can conclude as follows:

1. The highest readings (mean daily*) according to the dry thermometer were in July and August at 1 o'clock PM. At the same hour are the highest effective temperatures and rather high intensity of solar radiation (0.93 - 0.95 gram-calorie on a horizontal surface). If one considers that the Kuybyshev Observatory is at a distance of several kilometers from town, in a verdant area with no stone structures nearby, and is open to the winds, then the figures which would characterize the behavior of meteorological elements for Kuybyshev must, in comparison with the given figures, be changed toward the side of: first, increased dry-thermometer reading; second, increased readings of effective temperature; third, decreased wind velocity; fourth, somewhat increased absolute humidity; fifth, decreased intensity of direct solar radiation (because of much dust in the atmosphere and great content of water vapor); and sixth, increased reflections and diffused radiation.

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Upon analysis of indicated data, one can understand especially clearly the heavy sensation of heat which the inhabitants of Kuybyshev experience in summer months, especially in July and August.

The meteorological characteristics of the Kyznets regions is based on data of the following stations:

Table 5

Name	North Lat.	East Long.	Height above Sea level (meters)	Years of Observations
Kuznets, experimental Station (Verkne abliazovo)	53°03'	46°26'	251	1912 - 1935
Kuznets RR.	53°08'	46°38'	254	1929 - 1936
Yevlashevo	53°07'	46°50'	--	1929 - 1935

The climate of this region is continental with rather warm summers and cold winters. Spring is short with rapid temperature rise. Summer is long with rather stable periods of hot weather. Fall has gradual decrease in temperature. Winter is long and rather cold and is severe in certain individual years with sharp temperature fluctuations.

'Moisture turnover' (water cycle) is rather intense. According to yearly amount of precipitation the region occupies first place in the Pravoberezh'ye Region. [the region comprising the right bank of the Volga River]. Great snow falls are rather rare. The snow cover is comparatively deep and stable. In winter frequent snow storms with prevailing southwest and south winds occur.

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TEMPERATURE CONDITIONS

The mean yearly air temperature (for the period 1881 - 1930) is 3.1. Absolute maximum (1912 - 1935) is + 37, and absolute minimum (1912 - 1935) is - 42.1.

The average date of the first Fall frosts is September 22, with fluctuations according to individual years from September 9 to October 20.

The average date of the last frost (in air) is May 17 with fluctuations according to individual years from April 17 to June 12.

The data on temperature according to the average of many years for the Kuznets Station (experimental station) is characterized by the following figures:

Table 6	Years of observations	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
mean temperature, trul,	1881 - 1930	13.0	12.6	7.1	3.2	12.7	16.8	19.3	17.0
Absolute maximum	1912 - 1935	2.5	2.2	8.5	25.2	30.5	37.5	37.0	36.6
Absolute minimum	1912 - 1935	39.2	42.1	33.8	19.0	8.0	3.0	1.1	0.4
		Sep	Oct	Nov	Dec	For the year			
mean temperature, trul,	1881 - 1930	10.8	3.6	3.6	10.3	3.1			
Absolute maximum	1912 - 1935	29.5	24.0	15.5	6.0	37.0			
Absolute minimum	1912 - 1935	5.9	23.0	39.6	34.5	42.1			

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The frequencies of the mean daily (24 hours) air-temperature within the indicated limits (Kuznets experimental station, 1912 - 1934, mean-monthly number of days) is given in table 7 below:

Temperature from to		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	For the Year
34.9	30.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
29.9	25.0	1.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.4
24.9	20.0	3.0	4.4	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	2.0	10.6
19.9	15.0	6.3	6.6	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	4.7	20.8
14.9	10.0	7.5	6.2	6.2	0.3	0.0	0.0	0.0	0.0	0.0	0.3	2.3	7.5	30.3
9.9	5.0	6.9	5.5	7.4	1.6	0.0	0.0	0.0	0.0	0.0	0.7	5.8	9.4	37.3
4.9	0.0	5.6	3.7	10.2	5.2	0.3	0.0	0.0	0.0	0.0	5.2	11.9	5.3	47.4
10.1	15.0	0.4	0.2	3.8	10.9	2.1	0.1	0.0	0.0	1.9	12.4	7.5	0.9	40.2
5.1	10.0	0.0	0.0	0.0	7.0	6.6	1.3	2.0	0.6	9.8	9.8	1.3	0.0	36.4
10.0	15.0	0.0	0.0	0.0	4.7	9.7	7.3	0.8	10.3	12.9	2.3	0.2	0.0	50.2
15.1	20.0	0.0	0.0	0.0	0.3	9.6	12.2	15.3	12.3	5.2	0.2	0.0	0.0	55.1
20.1	25.0	0.0	0.0	0.0	0.0	2.7	7.7	10.7	6.3	0.2	0.0	0.8	0.0	27.6
25.1	30.0	0.0	0.0	0.0	0.0	0.0	1.3	2.2	1.5	0.0	0.0	0.0	0.0	5.0

Wind. The prevailing wind-direction for the year is southwest and west. A rather consider percentage is also south winds.

The greatest mean velocity of 5.4 m/sec characterizes the southwest wind (1925 - 1929); the least, 2.8 m/sec, characterizes the south wind.

The mean for Winter (December - March) is 27 days with snow storms, the gretest amount (8 days) being in January.

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In table 8 we give the frequency (in percentage) of winds of various bearings (1912 - 1916 and 1923 - 1929):

Bearing	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	For the Year
N	9	13	9	8	14	12	16	13	7	8	6	8	10
NE	9	11	9	8	13	12	13	10	7	8	5	9	9
E	11	6	11	9	10	9	11	11	6	7	5	8	9
SE	8	11	8	9	9	8	5	9	9	9	9	10	9
S	15	16	18	17	14	12	8	12	17	20	22	24	16
SW	25	23	26	24	16	18	16	17	25	24	28	22	22
W	18	14	14	18	15	19	20	21	20	18	19	14	18
NW	5	6	5	7	9	9	11	7	9	6	6	5	7

The frequency (in %) of winds of various directions during snow storms (December - March):

Bearings:	N	NE	E	SE	S	SW	W	NW
Frequency:	6	9	7	14	18	26	11	9

The prevailing wind direction during snow storms is southwest and south.

Precipitation. Yearly mean amount of precipitation is 446 mm. Maximum is 623 mm (1926); minimum is 265 mm (1924). Mean number of days with precipitation (all) is 166 days in one year.

The mean number of days with precipitation of 5 and more mm is 30 days in one year. The daily (24 hours) maximum of precipitation is 64 mm.

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The mean duration of stable snow cover is from 23 November to 20 April.

In Tables 9 and 10 we give figures for to precipitation:

Table 9		Jan	Feb	Mar	Apr	May	Jun	Jul
Precipitation (av. data for 1907 - 1931)		18	13	20	26	46	55	56
Greatest (1912 - 1928)		57	20	39	83	155	105	125
Least (1912 - 1928)		5	4	5	2	10	8	3
Number of days with precipitation (all)		15	12	14	12	12	13	13
With precipitation from 1 to 5 mm		6	3	5	5	5	4	5
With precipitation from 5 mm and greater		1	1	1	2	3	4	4
		Aug	Sep	Oct	Nov	Dec	For the year	
Precipitation (av. data for 1907 - 1931)		61	50	48	29	24	446	
Greatest (1912 - 1928)		155	132	114	69	51	623	
Least (1912 - 1928)		9	14	6	10	5	265	
Number of days with precipitation (all)		15	12	16	16	16	166	
With precipitation from 1 to 5 mm		6	5	6	5	7	62	
With precipitation from 5 mm and greater		4	3	4	2	1	30	

Table 10

	Decade	Nov	Dec	Jan	Feb	Mar	Apr
Depth of	1st (1-10)	1	8	24	37	44	24
snow cover	2nd (10-20)	2	13	29	40	46	10
(in cm)	3rd (20-30)	6	21	33	42	40	1

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Humidity of the air and atmospheric pressure. The mean daily relative humidity is 78%. The lowest, 61% (of the mean monthly), is observed in May; the highest, 91%, is observed in December.

The mean-yearly absolute humidity is 5.2 mm.

The greatest (of the mean-monthly) in July 10.5 mm.

The lowest in February is 1.3 mm.

The mean air pressure (reduced to sea level) is 762.5 mm. The highest (of the Mean-monthly) in February is 766.6 mm; the lowest is July is 756.4 mm.

Table 11

Elements	Years of observation	Jan	Feb	Mar	Apr	May	Jun	Jul
Relative humidity (mean)	1912 - 1928	87	86	88	77	61	64	66
Mean at all PM	1912 - 1928	87	82	80	66	46	48	50
Absolute humidity (mean)	1912 - 1928	1.4	1.3	2.0	4.5	6.5	9.4	10.5
Air pressure (sealevel)	1912 - 1928	765.2	66.6	62.8	62.2	61.6	68.2	56.4
		Aug	Sep	Oct	Nov	Dec	For the Year	
Relative humidity (mean)	1912 - 1928	72	74	84	90	78	78	
Mean at 1 PM	1912 - 1928	55	57	74	88	91	69	
Absolute humidity (mean)	1912 - 1928	9.7	7.2	5.0	3.2	2.2	5.2	
Air pressure (sealevel)	1912 - 1928	58.8	61.7	63.9	66.0	65.9	762.5	

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Duration of solar radiation. The mean number of clear days in the year is 35; overcast days number 178; days with fogs number 3.6. The total number of hours of solar radiation for the year is 1801 hours.

Table 12	Years of Observation	Jan	Feb	Mar	Apr	May	Jun	Jul
Number of clear days	1912-28	2	4	4	4	3	2	2
Number of overcast days	1912-28	21	16	16	11	11	10	10
Number of foggy days	1925-29	2.2	3.4	6.0	5.6	1.0	1.0	1.0
Total sum of hours with sun	1912-28	39	83	122	187	253	283	283
	Years of Observation	Aug	Sep	Oct	Nov	Dec	For the Year	
Number of clear days	1912-28	3	4	4	1	2	35	
Number of overcast days	1912-28	11	12	18	21	21	178	
Number of foggy days	1912-28	2.0	2.6	2.6	5.4	3.4	36.2	
Total sum of hours with sun	1912-28	225	169	93	37	27	1801	

Soil temperature. The beginning of the freezing of soil (to 10 cm) is observed, on the average, on 7 November, with fluctuations according to individual years from 10 October to 2 December; thawing is on 15 April, with fluctuations from 6 to 27 April. The mean number of days with frozen ground: at the depth: 0 cm

0 cm	180 day's
10 "	152 "
25 "	125 "
50 "	76 "
100 "	30 "

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The mean-monthly temperature of soil at various depths is characterized by the following data (1912 - 1928):

Table 13

Depth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average of Years
10 cm	3.6	2.4	1.2	2.5	11.3	16.7	18.8	17.2	12.3	5.4	0.4	2.6	6.6
25 cm	1.8	1.7	1.0	1.7	10.9	16.0	18.2	17.2	12.6	6.3	1.3	1.5	6.5
50 cm	0.6	0.8	0.4	1.2	8.9	14.0	16.8	15.2	12.9	7.4	2.6	0.1	4.6
100 cm	0.7	0.4	0.4	1.0	6.7	11.8	14.8	15.2	13.0	8.8	4.3	7.8	6.6

Maximum and minimum depth of freezing of soil, according to the data on 1912 - 1930, is characterized by the following figures:

Table 14

Depth Freezing	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Maximum	8	31	92	more	than	100		cm	
Minimum	0	0	1	22	24	22	20	0	0

In connection with the fact that the microclimatic survey of Beloye Ozero [White Lake], bordering on the Kuznets region, was begun by us starting in the Summer of 1936, it ^will be correct, if, for the sake of comparison with the given many-year meteorological data on the Kuznetsk region, we consider the behavior of the meteorological elements according to this region for the spring and summer months of 1936 and 1937. From Tables 15 and 16, given below by us, one can see that the spring and summer of 1936 sharply differ in their temperature data from the spring and summer of 1937.

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The spring and summer of 1936, as is known, were distinguished, in the Kuybyshev area by the great drought. The figures for relative humidity in the given tables are in this connection very characteristic. Especially, one notes the low relative humidity at 1: PM for these months in 1936. In spite of the relatively high temperatures according to the dry thermometer, both the mean-daily and, especially at 1:00 PM (table 16), the effective temperatures calculated by us according to the normal scale for these months turned out to be low; and most of the days in the sense of sensation of heat could be considered as comfortable. This is explained in the first place by the low relative humidity and by the sufficient "ventilation" of this region: the mean wind velocity was higher than 4 m/sec.

Table 15*

Months (1937)	Dry thermometer		Wet thermometer		Relative humidity		Wind Velocity		Effective temperature	
	mean daily* for the month	at 1PM	mean daily* for the month	at 1PM	mean daily* for the month	at 1PM	mean daily* for the month	at 1PM	mean daily for the month	at 1PM
May	10.1	12.8	--	--	66	54	5.5	6.6	0.2	2
June	16.1	19.6	12.5	12.9	68	55	3.3	4.9	9	12.5
July	19.4	23.4	16.0	17.1	71	52	2.5	4.2	13.5	16.5
August	18.4	22.6	14.8	16.5	68	50	3.3	4.6	11.5	15.5
September	14.9	21.1	11.0	13.5	65	42	3.0	5.0	9	14

*(Note: Data of the Kusnets Meteorological Station.)

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Table 16*

Month (1936)	Dry thermometer		Wind Velocity		Relative Humidity		Effective temperature	
	mean	at 1PM	mean	at 1PM	mean	at 1PM	mean	at 1PM
May	12.5	15.7	3.6	4.9	53	36	2.5	6
June	20.8	25.7	3.6	4.6	47	31	14	18
July	21.9	26.7	3.4	4.5	58	41	15.2	19.2
August	22.2	27.0	3.3	4.4	57	40	16	21

*(Note: Data of the Kuznets Meteorological Station.)

Unfortunately we do not have actinometric data for this region for 1936, because these measurements began only in the summer of 1937, and up to this time no measurements were made here. However, considering the meteorological situation of the summer of 1936 and the actinometric data obtained by us in the summer months of 1937, one can suppose that the intensity of solar radiation in the summer of 1936 was relatively high here. The figures for relative humidity in Tables 15 and 16 clearly confirm the statement that the greater the content of water vapor in the air the less the intensity of direct solar radiation and inversely. Thus in the sense of heat sensation in this region, in spite of the high intensity of solar radiation and relatively higher temperature according to dry thermometer, we shall still experience a state of "comfort", due to increased loss of heat because of low relative humidity and good ventilation of this region. The combination of effective temperature and solar radiation will correspond here most frequently to the conditions necessary for a "comfortable" sensation of heat.

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Table 15 characterizes the picture of a summer that is not hot and a cool spring and fall. Warm days in the Kuznets region for 1937 began actually on 30 June and stayed to 1 July. In May and in the middle of June it rained, but during July and August the weather changed very often: the warm days changed into cool and rainy. The effective temperatures, beginning in May to September inclusively, fluctuated from 0.2 (minimum) to 16.5 (maximum); that is, in the entire interval were lower than the "areas of comfort" established by Americans (according to the normal scale, "area of comfort" is between 17 and 22°).

However, each solar day, in spite of relatively low temperatures according to the dry thermometer, seemed to be, "comfortable" in the sense of heat sensation. This was especially noticeable in June after cool May with its monthly mean temperature of 10.1° and effective temperatures, from 0.2 to 2°. From our point of view this phenomenon can be explained by moments of "acclimatization" of the organism, which we also observed in the spring and summer of 1933, while working on the beach of Yevpatoriya, when for similar meteorological conditions any relatively warm day in comparison with a cool day seemed to be "comfortable". This once more confirms the correctness of our conclusions made in Yevpatoriya, Borovo and Kislovodsk (see our book "Fundamentals of Medical Climatology and Climatotherapy", published 1937) on the fact that the concept of "area of comfort" is doubly relative and requires large corrections mainly on account of solar radiation, moments of acclimatization, and so on.

As we have already mentioned, solar radiation in the region of Beloye Ozero [White Lake] was measured in the summer months of 1937. Without great error, the found values of the intensity of solar radiation can be

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related also to the Kuznets region. If we consider that these values from 7 AM to 1 PM in the region of Beloye Ozero were increased from 0.31 gramcalorie (on a horizontal surface) to 1.11 gramcalories (with relative humidity from 50.8 to 60.7%), then in Kuznets region for the same months with lower humidity especially at 1 PM, these values of the intensity of solar radiation were probably higher. That is why we can assume that, on the sunny days of the relatively cool summer of 1937 even for comparatively high temperatures according to the dry thermometer, heat sensation was most often "comfortable", thanks to the special role which solar radiation plays in heat sensation.

* * *

The microclimate of Beloye Ozero was formed under the influence of a whole series of factors. The climatic zone, just described, bordering on the climatic zone of Beloye Ozero is certainly the background which has considerably influenced the microclimate of Beloye Ozero; however, as we shall see later the latter (microclimate) differs very advantageously from the first. Many investigators of this region express the assumption that Beloye Ozero is an oligotrophic glacial relict and occupies the most elevated position in the territory (the highest point of the hill Shulga-Gordeyev). Dikson and Shikleyev discovered here a number of faunal forms which are found in northern Europe and high in the mountains. Shikleyev noted 6 arctic aspects. He supposed that a glacier cap formerly covered the peak of this hill and that during the glacier's melting the water originally flowed down all slopes of the hill and then infiltrating under the glacier gradually washing out the rather porous sand. As a result of this process a trough was formed which is possibly the bed of present-day Beloye Ozero [lake].

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The elevated position evidently distinguished this region also with respect to climatic conditions in general. Here is undoubtedly another climate, although close to that of the Kuznets region. It is characteristic, for instance, that the lake breaks out, relative to time, somewhat later, than all the rivers and water basins of the Kuznets region. Thus in 1931 this tardiness was expressed by 2 weeks. In winter in the most central point, where the village 'Uchlespromkhoz' [Student Forest Industry Economy] convalescence home and the resorts of various departments are located, there are no storms or blizzards, which are frequent for the Kuznets climatic zone. In winter the microclimate of Beloye Ozero is milder than in adjacent regions. Summers are warm but not hot and especially not sultry. The warmest months are July and August. ~~The hottest months are July and August.~~ During the hottest driest months for Kuybyshev Oblast in 1936, the maximum temperature according to the dry thermometer measurements made by us at Beloye Ozero did not exceed 34.8° (one day); maximum effective temperature during this time was not higher than 26° . The mean temperature for July and August was $21-22^{\circ}$. The mean relative humidity for the same months was 62-70%. The mean wind velocity was from 2 to 3 m/sec.

For the entire period of observations, by asking people who were convalescing, we noted, according to the "method of effective temperatures", only 2-3 sultry days. Here, convalescent neurotics, chronic-malarial patients, other convalescents, and continuous-convalescing small groups of people with functional heart disease are especially sensitive. Our attention was also directed to the 'self-sensitivity' of the child population of the Uch-les-prom-khoz [Student Forest Industry Economy]. The children felt very well and they never complained of the hot weather and did not

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suffer this season from puerile summer diarrhoeas characteristic of the summer of 1936 in the Kuybyshev Oblast.

Also during these months we did not observe any cases of malaria, which is so usual for a number of regions in Kuybyshev-Oblast. For July and August 1936 the Kuznetsk meteorological station noted at 1 PM a mean temperature, according to the dry thermometer, of $26.7-27^{\circ}$; a relative humidity in this time of 40-41%; and an effective temperature of $19.2-21^{\circ}$.

At Kuybyshev the mean temperatures for July and August 1936 at 1 PM, according to the dry thermometer, were $28-29^{\circ}$. With light winds and much reflected and diffused solar radiation at that time the air was very sultry and did not change even in the evening or night, because of the fact that in this interval the absolute humidity increased and the movement of air decreased and because of the fact that convection currents of air were greatly heated by stone buildings, bridges, pavement and roof, thus increasing by this combination of meteorological elements, the sultry weather.

The almost entire absence of neolorial cases and puerile diarrhoea we are inclined to explain by meteorological factors.

As is known, the first and main factor of thermoregulation is basomotor reaction which is connected with the distribution of blood in the organism. At high air-temperatures the need of the organism to lose heat to the surroundings causes dilatation of the peripheral blood vessels and causes redistribution of the blood toward the periphery and acceleration of blood flow. At the same time perspiration begins sometimes to a great extent, which cause a great loss, through sweating of salt (NaCl),

which plays a very great role in processes governing osmotic pressure. This, as is known often leads to disruption in the organism's saline equilibrium. The passage of great amounts of blood to the skin's network of blood vessels evidently must cause a relative anaemia of the internal organs, during insufficient compensation, and considerable anaemia in the part of the organism with thickest reservoir of blood vessels and requires during their functioning the greatest variations and filling with blood, of the individual organs. Consider now the intestinal canal as it relates to the muscular system, spleen and other organs. If the influence of high air-temperatures (heated air-masses or so-called convection heat) with increasing humidity and calm is of long duration then it can cause disturbances in certain functions of the organism, especially in children. Without speaking of the possible consequences of the load on the heart, which has to push the thickened blood, the loss of chlorides depletes the supply of chloride ions on the blood, which serves to supply the stomach with hydrochloric acid. Such a deficit in chloride ions can lead to decreased acidity of the gastric juices, resulting even in achylia. This has been confirmed by a series of observation and is reflected in our literature (Gel'man Miller, et alii). The experiments of Dr Danilov on dogs, which were carried out by him in special chambers particularly deserve consideration in this respect (see the data of 'Conference of Physiologists for 1937'). The diminished stomach acidity and even achylia, as is known do not yet represent a pathological condition but one must assume that under these circumstances infections of various kinds (intestinal disease) may penetrate the abdomen.

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That is the reason why we think that the presence of unfavorable meteorological moments (enhanced convection heat, heated air-masses) under continuous influence might lead to intestinal diseases, particularly in children, whose organism in this connection is most affected. A great redistribution of blood and influence on smooth muscles and spleen, as is known, also are predisposing conditions that bring relapses in chronic malaria. A great number of experiments have shown that the heightened convection heat with great humidity and calm, as well as continuous cooling of the organism with high humidity (when the so-called negative radiation of the organism increases) actively induces malaria. Besides, to favorable meteorological conditions in the region of Belye Ozero, the almost complete absence of malaria and children's summer diarrhoea is due to more favorable sanitary conditions in comparison with others regions of Kuybyshev, to the insignificant swamp area, and to almost a complete absence of mosquitos.

As was mentioned above, the summer of 1937 was relatively cool. Against a background of a "cool" summer, all three climatic zones have their own peculiarities, partly described by us above.

In July and August of 1937 in the region of Belye Ozero we had the following meteorological picture:

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Table 17

Months	Dry therm.		Velocity Air Movement		Effective temperature		Relative Humidity	
	mean for the month	at 1PM	mean for the month	at 1PM	mean for the month	at 1PM	mean for the month	at 1PM
July	19.7	21.4	2.2	2.5	14.6	15.8	66.7	57.8
August	21.9	22.1	1.5	1.2	15.7	17.7	57.6	50.8

Intensity of solar radiation is given in the following table:

Table 18

Month (1937)	Name of Observatory	Hour											
		7	8	9	10	11	12	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM
July	Kuybyshev	0.95	0.38	1.10	0.76	1.14	0.92	1.12	0.93	1.06	0.73	0.94	0.94
	Beloye Ozero	0.97	0.38	1.12	0.70	1.28	1.00	1.30	1.10	1.24	0.95	--	--
August	Kuybyshev	0.94	0.31	1.12	0.66	1.23	0.89	1.21	0.91	1.13	0.68	0.90	0.90
	Beloye Ozero	1.00	0.31	1.20	0.60	1.38	1.04	1.37	1.11	1.31	0.92	--	--

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In July during the hours of our observations the intensity of solar radiation increased from 0.38 gramcalorie. All sunny days without exception, when we carried out meteorological and actinometrical observations, for this period were "comfortable" in the sense of feeling of warmth, in spite of the fact that the mean-daily and 1-PM effective temperatures were lower than the usual "zone of comfort." This can be explained by the relatively high intensity of solar radiation, which we have here because of the transparency of the atmosphere. This is also due to the low relative humidity of 50.8-66.7% and continuous breezes. At 1PM, as one can see from Table 18, the Kuybyshev Observatory for these months showed comparatively low intensities of solar radiation from 0.90 to 0.93 gramcalorie on a horizontal surface. As we mentioned above, in Kuybyshev during these hours the reflected radiation was certainly increasing on account of the infra-red rays of the spectrum, which are considerably less in the Beloye Ozero region. The violet and ultra-violet part of the spectrum is certainly greater with the indicated meteorological conditions in Beloye Ozero.

The Kuybyshev Observatory for these months also gives higher effective temperatures, 16.5 to 18.5°. Considering, as was noted above, that the Observatory is out of town, one must, therefore, during all readings register essential corrections, and assume that the effective temperature in Kuybyshev actually have considerably higher values.

Thus the microclimatic data of the three climatic zones at our disposal allow us to make the following conclusions:

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1. In comparison with the Kuznets, the climatic zone of Kuybyshev is in sharp contrast climato-physiologically speaking. The climatic zone of Kuybyshev is a characteristic example of an accumulation of greatly heated air-masses (convection heat) in summer months (July and August), as a result of which the favorable ('tonicizing') action on the organism of solar radiation is lost, which, with the presence of meteorological conditions unfavorable for loss of heat becomes frequently the source of overheat in the organism with all its evil consequences.

2. The microclimate of Beloye Ozero depends on more favorable -- in comparison with Kuybyshev -- meteorological conditions of the Kuznets climatic zone.

3. The microclimate of Beloye Ozero differs in its turn advantageously from the Kuznets climatic zone in a whole series of factors:

- (a) The winter period is milder.
- (b) The hottest summer months, July and August, as a ^{rule} ~~rule~~ show an absence of high air-temperatures, particularly at 1 PM, because of: (a) the moderating action of the forest mass (overshading, humidity, low albedo) around Beloye Ozero, a great water-basin absorbing heat rays; (b) the presence of light almost continuous winds 1.2 to 2.5 m/sec in velocity; (b) more elevated topography (the highest point of Kuznets region).
- (c) Although insignificant in degree, but still lower in comparison with the Kuznets climatic zone, the relative humidity depends in the given case on the altitude of the locality, air temperature, and winds.

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(d) Because of the transparency of the atmosphere, Beloye Ozero has higher intensities of solar radiation which, for the above-described favorable meteorological conditions, can act favorably on the organism, increasing the functional tonicity of its tissues.

Thus, climato-physiologically speaking, the Beloye Ozero region in summer months represents a peculiar forest climate with low humidity, pure air, absence of high air-temperatures, presence of light breezes, relatively high mean-daily intensity of solar radiation (0.85 gram-calorie). At 1 PM it increases to 1.1 gram-calorie. The effective temperature is not high; although it lies below the established "zone of comfort", of American scientists it gives, in combination with above-mentioned intensity of solar-radiation, still in most cases "a comfortable" feeling of warmth.

We propose that the people who can convalesce in this climatic zone are: people overfatigued or suffering from secondary anaemia, neurotics, and cardiac patients with functional heart disorders, to whom regulated amounts of swimming in a lake and walks in the woods can be recommended, also sick people suffering from chronic bronchitis, and dry, particularly chronic malaria.

As for sick or convalescent children, they may rest and be treated with great success (bathing in the lake, walks in the woods, aeration, strictly dosed heliotherapy); also children of the erethetic and irritative type with neuropathic constitution. It is a very desirable place for carrying out summer health campaigns among children and for organizing pioneer camps during the entire summer.

The possibility is not excluded of building a tuberculosis sanatorium' for adults as well as for children farther from the lake, in the middle of the forest in the driest areas, interspersed with meadows and bounding with open fields.

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[Figures follow]

1. Meteorological Observations.
2. Klimatic Station of the Medical Institute
3. Base of the 'Beloye Ozero' Climatic Station.